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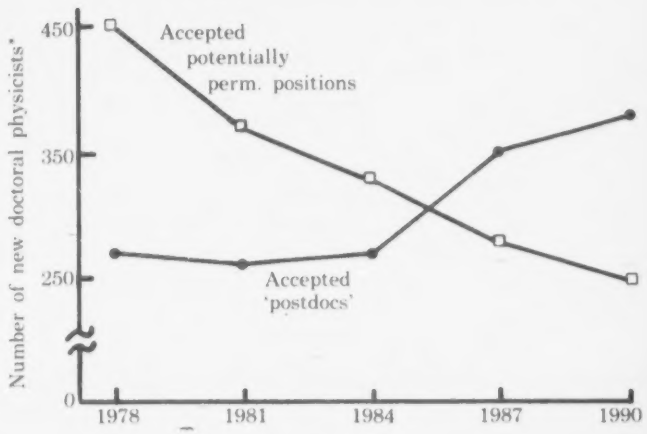
1989–90
GRADUATE STUDENT SURVEY

The need has never been greater than in the 1990s for reducing complex situations to their fundamental aspects, a task well suited to the capabilities of physicists. Hence a sustaining demand for physicists need not be questioned. The largest number of physicists is educated in the United States where academic institutions offer a wide variety of graduate degree programs and attract a student body from all over the world. The annual Graduate Student Survey has been monitoring the characteristics and diversity of physics students for three decades to report on changes in their educational backgrounds, their choice of subfields and their employment prospects at both master's and doctoral levels. A parallel but separate annual survey is directed at the graduate astronomy students and dates back to the mid 1970s. The highlights of this report are:

- Since 1985 the number of U.S. citizens who accepted physics 'postdocs' annually, rose by 40%.
- Employers, offering permanent positions to new doctoral-level physicists, prefer experimentalists over theoreticians.
- Postdoctoral salaries for astronomers have increased to equal those of physicists.

Despite the broadly based training physicists receive, the impact of our recent economic recession causes concern among advanced graduate students about the availability of scientific employment for new physicists. However, when focusing on new physicists, we need to recognize that the employment opportunities are not the same for all the members of a given graduating class; it is the citizenship of the degree recipients that makes the difference. For example, at the doctoral level, U.S. citizens have a choice between a temporary postdoctoral fellowship or a potentially permanent position, whereas foreign doctoral graduates, who wish to remain in the United States for their initial employment, hold visas which, by and large, limit them to one two-year postdoctoral fellowship. It is because of these differences that the two groups require separate analyses; consequently **Figure I** presents only the initial employment of U.S. citizens.

Figure I. Initial employment, in the U.S., accepted by new U.S. physicists.



The numbers of physicists are scaled-up three-year averages.

A recurring question concerning the U.S. citizens among the doctorate recipients, is: Do an increasing number of them choose temporary rather than permanent initial employment, and why? The data in **Figure I** have been scaled up to represent the total production of U.S. doctoral physicists in each of the two categories of initial employment. Thus, by adding together the two groups we notice a rapid decline from 720 to about 620 U.S. doctorates/year between the late 1970s and the early 1980s, followed by an almost constant production of new U.S. physicists through 1990. Viewing the two types of initial employment separately, we find intersecting trends for the decade of the 1980s. For example, a 3:2 ratio of accepted permanent to temporary positions in 1980, became a 2:3 ratio by 1990. The answer to why so many new U.S. physicists chose 'postdocs' has only anecdotal data at this time; apparently, the experience that a two or three year postdoctoral fellowship represents, is the preferred preparation for a tenure-track faculty position of which a fair number are expected to open up in the 1990s. The declining acceptance rate of permanent positions by new U.S. physicists may be a matter of choice rather than one of availability as shown by a follow-up survey of these graduates.

Member Societies: The American Physical Society • Optical Society of America • Acoustical Society of America • The Society of Rheology • American Association of Physics Teachers
American Crystallographic Association • American Astronomical Society • American Association of Physicists in Medicine • American Vacuum Society • American Geophysical Union

Table I. Characteristics of the graduate physics student population, 1989–90.

Characteristics		All graduate students	First-year graduate students	Degree recipients: terminal masters	Degree recipients: doctorate recipients
	*Total population:	13 708	3 059	748	1 183
	Number of respondents:	8 294	1 775	345	722
Sex	Female	14%	16%	*17%	*9%
	Male	86	84	83	91
Citizenship	U.S.	*59%	*56%	77%	60%
	South & Central America	2	2	1	2
	Europe, Canada, Australia & New Zealand	8	9	2	9
	East Asia	24	27	13	22
	Central Asia & Middle East	6	6	7	6
	Africa	1	–	–	1
Physics in high school	Yes	93%	92%	89%	93%
	No	7	8	11	7
Major of bachelor's degree	Physics	88%	85%	78%	90%
	Mathematics	2	2	2	3
	Engineering	7	9	14	4
	Other phys. sciences	2	2	3	1
	Other	1	2	3	2
Type of bachelor's institution	PhD-granting	40%	40%	38%	44%
	MS-granting	6	8	15	3
	BS/BA-granting	15	16	25	14
	Foreign	39	36	22	39
Type of graduate institution*	PhD-granting	91%	86%	74%	100%
	MS-granting	9	14	26	–
	Public	70%	72%	79%	61%
	Private	30	28	21	39

* *These data were derived from the survey of Enrollments and Degrees.*

Having focused exclusively on U.S. citizens in **Figure I**, we are providing a more detailed account of the foreign students in **Table I** which compares six characteristics of the total graduate student population with those of three subgroups, namely, the first-year graduate students, the terminal masters and the doctorate recipients. Citizenship is the second characteristic, and instead of simply listing "U.S." and "foreign," we divided the foreign students into five groups using the continents they came from as an approximate guide; students from three British Commonwealth countries (Australia, Canada and New Zealand) were included with those from Europe. East Asians are the fastest growing group of foreign students. They comprised 27% of the first-year students, 24% of the total population and 22% of the doctoral graduates. It is also clear that only a small proportion of the foreign students terminate their study of physics at the master's level, and when they do, it is largely to continue their graduate studies in another discipline.

The fourth characteristic in **Table I** illustrates that the influx into physics from other disciplines is generally small. Engineering graduates remain the largest group among the transfer students and comprised as much as 14% of the terminal masters in 1989-90. To call attention to the attrition rates we compare the graduate enrollment at public with that at private institutions; on that basis we find a considerably lower attrition at the private institutions because their share of the first-year students was so much lower than that of the doctorates conferred.

Since certain racial groups, who comprise minorities in the U.S., form large proportions of the foreign graduate students, we need to distinguish between the U.S. and foreign citizens as we present their characteristics in **Table II**. To facilitate comparisons among eleven groups, we used percentages for the first time and show the number of students who identified themselves in each group in the first row. From the percentages that describe the 1989-90 enrollment, we find that foreign Asian Indians included the highest proportion of women; foreign students, by and large, are older than their U.S. counterparts and native American Indians and U.S. blacks are more likely to be supported by fellowships than the members of other minority groups. The numbers of degree recipients, quoted for each group, were reported by physics department chairpersons as part of another survey.

Table II. Characteristics of minority group graduate physics students, 1989–90.

		Black		Native American	Hispanic		Asian Indian		Oriental		Arab	
		U.S.	Foreign	Indian	U.S.	Foreign	U.S.	Foreign	U.S.	Foreign	U.S.	Foreign
Number of respondents:		77	29	20	114*	106	28	342	186	2041	25	120
Characteristics												
Sex	Female	17%	21%	–	10%	13%	11%	24%	17%	17%	–	11%
	Male	83	79	100%	90	87	89	76	83	83	100%	89
Degree program enrolled	TMS	14%	10%	21%	7%	5%	11%	8%	10%	8%	16%	9%
	Doctoral	83	87	74	92	95	89	92	89	92	80	88
	None	3	3	5	1	–	–	–	1	–	4	3
Age	≤24 yrs	16%	7%	10%	19%	8%	36%	21%	26%	11%	16%	13%
	25–26	26	17	10	20	8	36	20	22	17	20	19
	27–28	17	14	55	17	15	7	22	21	26	20	17
	29–32	18	21	25	25	49	11	23	20	27	36	29
	≥33 yrs	23	41	–	19	20	10	14	11	19	8	22
Full-time equivalent years of graduate study	≤1	25%	28%	40%	26%	12%	36%	18%	22%	22%	32%	18%
	2	30	31	10	27	19	21	22	20	20	20	22
	3	20	21	10	11	18	18	15	17	16	12	16
	4–5	10	10	40	17	33	11	28	27	30	16	23
	≥6	15	10	–	19	18	14	17	14	12	20	21
Sources of support	Teaching ass't	14%	45%	20%	25%	38%	32%	52%	19%	43%	32%	49%
	Research ass't	22	14	20	25	31	39	36	41	45	24	33
	Fellowship	34	21	35	29	9	14	3	18	3	12	3
	Personal funds/ other	30	20	25	21	22	15	9	22	9	32	15
Number of graduate degree recipients**	TMS	15	8	–	4	9	9	32	18	92	3	14
	Doctorates	5	5	–	4	17	6	83	29	250	–	23

* *The 114 U.S. Hispanics consist of 19 Puerto Ricans, 27 Mexican-Americans, and 68 other U.S. Hispanics.*
** *These data were derived from the survey of Enrollments and Degrees.*

Although a subfield need not be chosen by a graduate student until he or she has completed the required course work and decides on an area of concentration for his or her research, many graduate students make that choice early on. **Table III** lists ten subfields and the scaled-up numbers of graduate students at each of nine levels of graduate study. A specific function of **Table III** is to estimate the number of graduate students in a given subfield who will seek employment in a year or two.

Table III. Number of graduate physics students, by subfield* and years of graduate study completed, 1989–90.

		Full-time equivalent years of graduate study									Total graduate students	
		≤ 1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	≥9 yrs.	N	%
Distribution of students	N	3 059	2 850	2 195	1 850	1 605	1 070	590	275	214	13 708**	
	%	22.3	20.8	16.0	13.5	11.7	7.8	4.3	2.0	1.6		100%
Astrophysics		245	170	170	125	115	65	40	25	20	975	7.1
Bio/medical physics		120	110	90	70	70	30	15	10	5	520	3.8
Condensed matter		815	840	715	640	600	410	190	90	70	4 370	31.9
Electron, atomic, molecular		150	205	140	130	105	80	60	20	30	920	6.7
Elementary particles		325	295	280	250	190	140	95	50	20	1 645	12.0
Mathematical physics		210	190	135	95	75	60	35	10	10	820	6.0
Nuclear physics		150	165	165	155	140	75	40	20	20	930	6.8
Optics/lasers		265	230	130	90	80	50	25	15	5	890	6.5
Plasmas/fluids/chaos		105	140	110	90	85	55	30	15	15	645	4.7
Physics applications		225	205	95	75	55	50	20	10	5	740	5.4
Other subfields		449	300	165	130	90	55	40	10	14	1 253	9.1

* *The distribution of students in each subfield is based on 8081 respondents to this question.*
** *The total was derived from the survey of Enrollments and Degrees.*

Table IV. Sources of support for graduate physics students, by type of institution and citizenship, 1989–90.

Source of support		Doctor's-granting institutions				Master's-granting institutions			
		U.S. students		Foreign students		U.S. students		Foreign students	
		First-year students	Advanced students	First-year students	Advanced students	First-year students	Advanced students	First-year students	Advanced students
Teaching assistantship		48%	19%	64%	35%	22%	32%	50%	55%
Research assistantship		12	52	17	50	3	10	24	21
Fellowship		18	12	7	5	3	1	1	–
Foreign government		–	–	3	2	–	–	2	3
Family, savings		4	2	5	2	13	10	6	10
Full-time employment		10	7	1	1	42	35	5	3
Other*		8	8	3	5	17	12	12	8
		100%	100%	100%	100%	100%	100%	100%	100%
Estimated distribution of all graduate students	N**	1 475	5 637	1 148	4 180	249	565	187	267
	%	11	41	8	31	2	4	1	2

* *"Other" includes the military and part-time employment.*
** *These data were derived from Tables VII and VIII in the survey of Enrollments and Degrees.*

A further expansion of last year's version of **Table IV** distinguishes between beginning and advanced graduate students, one that is particularly important when discussing sources of support. Similar to last year's analysis, the graduate enrollment is separated on the basis of citizenship and type of graduate institution. Thus it becomes clear that teaching assistantships are primarily offered to the beginning graduate students at PhD-granting institutions and to a majority of all foreign students at master's institutions. Full-time employment appears to be a major source of support largely for U.S. students at master's institutions; their study status is therefore part-time and they require at least three or four years to complete terminal master's degrees. The totals given at the bottom of **Table IV** suggest that the large universities attract substantial amounts of research funds which in turn provide several thousand graduate students with research assistantships.

Given the emphasis physicists place on the intensive professional work that ultimately leads to a dissertation, we singled out the doctoral candidates, grouped them by type of research within each subfield and present this array in the form of **Table V**. The last two rows of this table show that the ratio of experimentalists to theoreticians remains at 2:1.

Table V. Number* of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, 1989–90.

Physics subfield	Type of research	Full-time equivalent years of graduate study							Total		
		3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	≥9 yrs.	N	% Exp.	% Theo.
Astrophysics	experimental	100	75	55	35	20	10	10	305	5.8	
	theoretical	60	50	55	40	25	15	10	255		9.9
Bio/medical	experimental	60	55	60	30	15	10	5	235	4.5	
Condensed matter	experimental	510	460	425	325	160	75	65	2 020	38.7	
	theoretical	170	155	170	80	45	20	10	650		25.2
Electron, atomic, molecular	experimental	120	105	95	55	60	10	20	465	8.9	
	theoretical	30	30	25	15	5	10	5	120		4.7
Elem. particles	experimental	150	175	130	110	90	50	15	720	13.8	
	theoretical	145	90	80	55	30	10	–	410		15.9
Math. physics	theoretical	170	120	95	80	45	10	10	530		20.6
Nuclear	experimental	125	110	100	60	30	15	20	460	8.8	
	theoretical	40	50	55	25	15	10	5	200		7.8
Optics/lasers	experimental	105	65	65	30	25	10	5	305	5.8	
Plasmas/ fluids/chaos	experimental	65	55	40	30	20	10	5	225	4.3	
	theoretical	40	30	45	25	5	5	5	155		6.0
Physics applications	experimental	65	50	40	30	15	5	5	210	4.0	
Other subfields	experimental	80	85	25	30	35	15	10	280	5.4	
	theoretical	80	75	65	30	–	–	4	254		9.9
Total	experimental	1 380	1 235	1 035	735	470	210	160	5 225	100.0%	
	theoretical	735	600	590	350	170	80	49	2 574		100.0%

* *The numbers in this table have been scaled up to reflect the total number of graduate students (7 799) who completed three or more years of graduate study.*

Table VI. Distribution by subfield and employment offers for doctorate recipients, 1989–90.

Physics subfield		Total in subfield	New 'postdocs' in the U.S.	Employment-oriented graduates in the U.S.	Percentage of graduates seeking potentially permanent employment in the United States received: 0 job offers	1 job offer	≥2 job offers
Astrophysics		7.1%	4.6%	3.2%	10%	68%	22%
Biophysics		3.3	2.1	1.5	11	22	67
Condensed matter		34.7	21.8	13.5	14	49	37
Electron, atomic, molecular		7.7	5.0	2.6	7	53	40
Elementary particles		16.9	12.3	3.4	5	50	45
Mathematical physics		7.0	4.3	3.1	22	56	22
Nuclear		7.4	5.0	1.7	20	70	10
Optics/lasers		4.3	1.0	3.2	5	37	58
Plasmas/fluids/chaos		4.1	2.7	1.7	10	60	30
Applied physics		3.1	1.0	2.2	8	46	46
All other subfields		4.4	1.8	2.3	14	36	50
Total	%	100%	61.6%	38.4%	12%	50%	38%
	N	1 183	642*	392*			
All experimental subfields		63%	390	268	10%	48%	42%
All theoretical subfields		37%	252	124	17%	60%	23%

**An estimated 149 doctoral graduates, not part of the employment analysis, include 141 who leave the U.S. and 8 whose plans are described in Figure III.*
Note: The "job offer" portion of this table does not include graduates with commitments to foreign employers.

Degree recipients

Doctoral graduates share a strong desire to choose the most appropriate type of employment because they have invested a great deal of time to achieve so high a degree of specialization. To highlight the extent to which the technological relevance varies for different subfields, we have arranged the data in **Table VI** to reflect the specific goals pursued by the doctoral graduates in the class of 1990. The first column of percentages shows the subfield distribution of all degree recipients. These data are followed by the proportions in which the graduates chose two types of employment in the U.S. Here the physics subfield and the research method were influential in deciding between postdoctoral fellowships and potentially permanent positions. However, since postdoctoral fellowships continue to be readily available, we focus, in the right-hand portion of **Table VI**, on those new physicists who were interested in permanent positions and tie their success, in terms of job offers, to the subfields of their dissertations. When examining the column of percentages under "zero job offers," one should keep in mind how small a number of graduates each subfield involves. It is therefore more meaningful to compare the collective data on job offers with those of the previous year. Thus the average of 12% shown under "zero job offers" for 1990, compares with 7% for the class of 1989; multiple offers declined ten percentage-points in one year to 38% for the class of 1990.

For a number of years we made the statement that employers prefer to hire experimentalists over theoreticians; not only do the data in **Table VI** substantiate this statement by showing that 10% of the experimentalists and 17% of the theoreticians reported "zero job offers" but one could also conclude that an experimentalist is twice as likely as a theoretician to receive multiple offers.

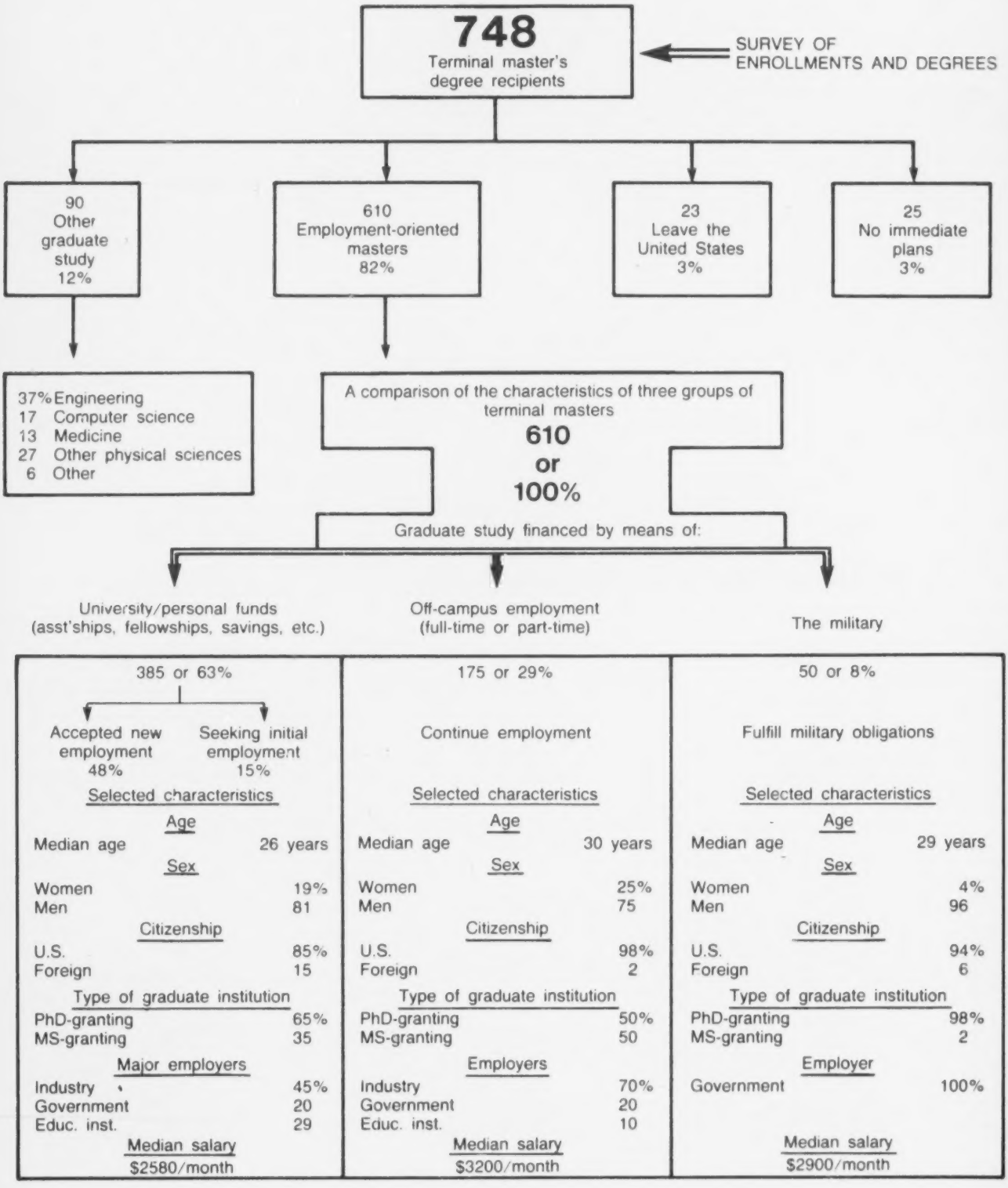
Among the measures that determine demand for new physicists is the availability of permanent employment for them. Our information on this topic does not come directly from employers, but the job offers accepted and reported by degree recipients present a meaningful assessment of the demand for any given year. The declining acceptance rate of potentially permanent positions by U.S. citizens, shown in **Figure I**, should not be interpreted as reflecting a decline in the number of openings that exist. Foreign doctorate recipients, comprising almost 40% of the new physicists in 1990, were also interested in permanent employment in the U.S., but a far more complicated hiring process needs to be followed by the employers. Unless a foreign degree recipient is a permanent resident in the U.S., the U.S. employer needs to convince the Immigration and Naturalization Service to change the graduate's student visa to what is known as a "green card." This process is both time-consuming and expensive for an employer; yet **Table VII** shows that 18% (up from 13% in the previous year) of the foreign graduates in the class of 1990 reported accepting potentially permanent positions.

Table VII. Employment of doctoral graduates by citizenship, 1989–90.

Doctoral graduates		U.S. employer 'Postdoc'	U.S. employer Pot. perm. employment	Foreign employer 'Postdoc'	Foreign employer Pot. perm. employment	Uncommitted in the U.S.	Total %	Total N	Total %
U.S. citizens		55%	34%	5%	–	6%	100%	438	61%
Foreign citizens		55	18	12	9%	6	100	278	39
Total	%	55	27	8	4	6			100%
	N	392	198	57	28	41		716	

Note: Six graduates had no immediate plans.

Figure II. Post-degree plans of physics terminal master's degree recipients, 1989–90.



Perhaps the most diversified group of graduates is the one granted terminal master's degrees in physics. To elaborate on that statement, let us examine the circumstances that led them to this degree. There is the group of physics bachelors that started graduate study in physics without interruption but was unwilling to commit six years to a doctoral program. Then there are the physics bachelors who chose immediate full-time employment but were urged by their employers to enroll in a limited graduate program aimed at a specific applied subfield, possibly optics, and stayed with the program until they completed a master's degree.

Another group of terminal masters considers two years of graduate-level physics an excellent technical background for graduate work in another discipline; a majority of the members in this group are foreign students. And yet another group consists of potential doctoral candidates who were unsuccessful in passing the qualifying exams. **Figure II** relates specific background characteristics to the professional activities of physics masters in the class of 1990. In an attempt to retain and highlight a number of differences in their characteristics, we divided the employment-oriented masters into three subgroups based on how their graduate study was financed. The largest of these subgroups has little or no work experience, its members were supported by university or personal funds and their median age is only 26. Another group of masters returned to school because their employers convinced them that some graduate course-work would be beneficial in furthering their careers; its members are primarily employed in industry, they reported the highest median salary and they include the largest proportion of women. A small but distinct group are the masters whose graduate education was financed by the military. These degree recipients are definitely not in the job market because they are fulfilling military obligations and each year a majority of them graduate from the Naval Postgraduate School in California.

Table VIII. Distribution of terminal masters by subfield and use of physics training, 1989–90.

Physics subfield	% of degree recipients*
Acoustics	5%
Astro-geophysics	10
Bio-medical physics	7
Condensed matter	20
Mathematical physics	5
Nuclear	5
Optics/laser	13
Applied physics	11
Physics education	4
General physics	7
All other subfields	13
Total	100%

* *Based on 345 respondents.*

The number of terminal master's degrees granted each year is reported by physics department chairpersons and for the academic year 1989-90 the total of 748 degrees represented a ten percent increase over that of the previous year. Information on the subfields of their research projects or theses was contributed by 345 degree recipients whose distribution is shown in **Table VIII**.

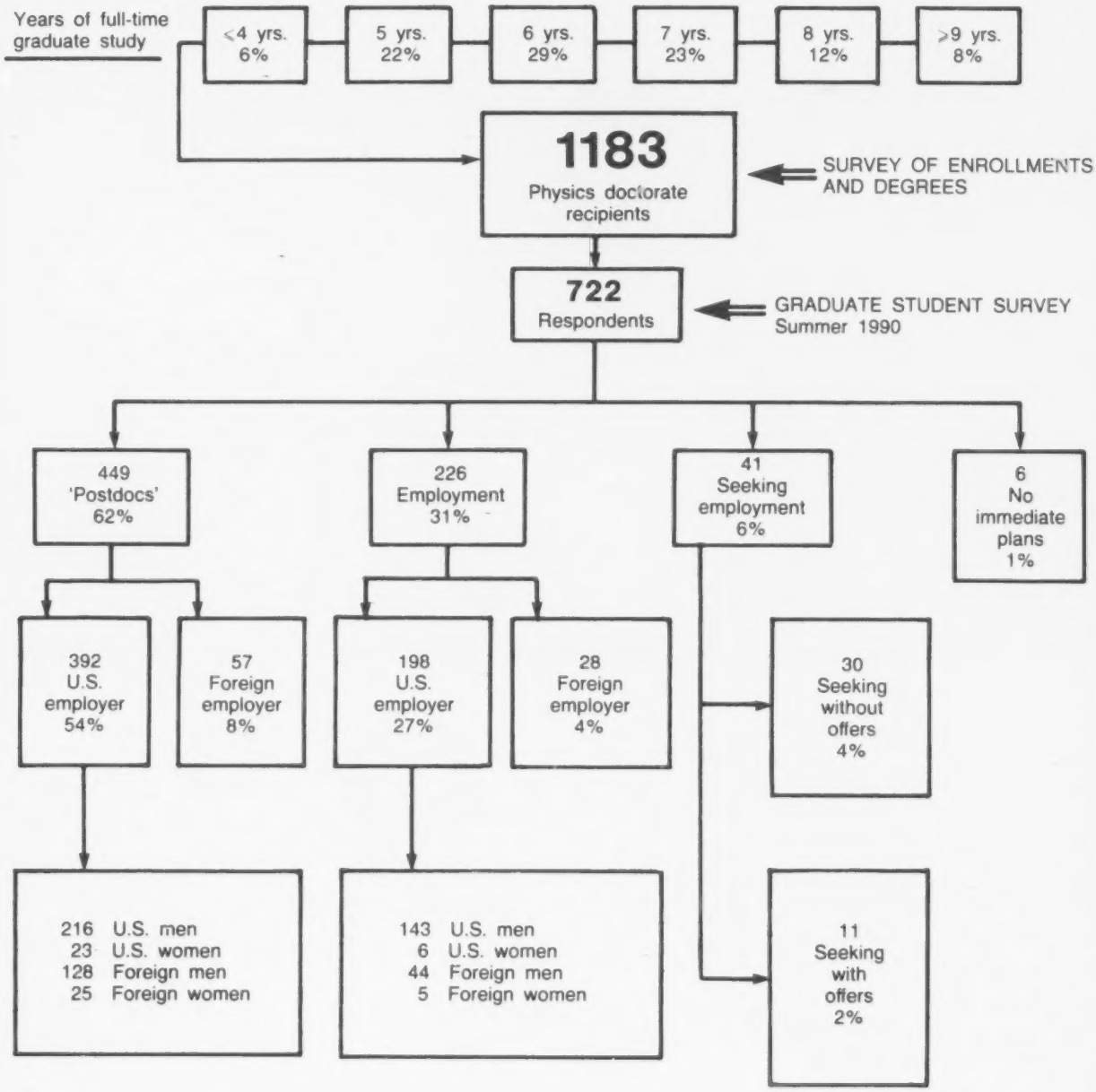
For a comprehensive employment picture of the new physics masters, we combined the three groups in **Figure II** to present **Table IX** which relates seven types of employers to the major work activities and the extent to which these physicists use their training. As was done in previous years, we list the three types of academic employers separately. Employment as secondary school teachers increased by four percentage-points. Since the preparation of masters is so well suited to industry, it remains their largest employer.

Table IX. Employment characteristics and use of physics training of 1989–90 master's degree recipients.

Work activity		Type of employer: University	College	Secondary school	Industry	Government	Military service	Non-profit organization	Total N	Total %
Teaching		13	23	38	–	–	1	–	75	14
Research		15	–	–	20	13	2	6	56	11
Res. and dev.		19	3	–	78	35	7	4	146	28
Engineering		–	–	–	94	14	1	–	109	21
Programming		–	–	–	16	19	–	6	41	8
Management		–	–	–	16	3	5	3	27	5
Nonphysics prof'l		–	–	–	26	3	34	3	66	13
Total	N	47	26	38	250	87	50	22	520	
	%	9	5	7	48	17	10	4		100%
Use of physics training:	extensive	31	23	30	104	49	12	13	262	51
	little	12	3	8	125	31	38	3	220	42
	none	4	–	–	21	7	–	6	38	7

Note: The data in this table reflect the employment information contributed by individual degree recipients as well as department chairpersons.

Figure III. Post-degree plans of physics doctorate recipients, 1989–90.



The influx of foreign students, some of whom enter doctoral programs with advanced standing while others require extra time to concentrate on their English language skills, has introduced fluctuations in the distribution of the parameter we define as "years of graduate study required to complete a physics doctorate." This distribution forms the top row of **Figure III** and indicates that 28% of the doctoral graduates in the class of 1990 required at most five years to complete their PhDs. For the class of 1985, the corresponding percentage was 42; during the early 1980s, between 38% and 46% of the doctorate recipients required five years or less to complete that degree.

Little more needs to be said about the types of employers and work activities of 'postdocs'; however, of major concern are the kinds of opportunities that allow new physicists to translate their basic discoveries into further contributions to technology. **Table X** therefore singles out the physicists who reported on their newly-accepted permanent positions and relates the employers to the work activities and the utilization of their training. Although industry remains the single largest employer, a smaller proportion of new doctoral physicists accepted its highly-paid positions in 1990; the decrease to 40% involved a six percentage-point decline from that shown for the previous year's graduates. Another notable change from 1989 was the increase from 16% to 23% in permanent positions accepted at universities. Among the work activities the shifts corresponded to a decrease in research and development work, from 40% to 34%, and an increase in research and teaching from 13% to 18%.

Table X. Employment with potential permanence in the U.S. for 1989–90 physics doctorate recipients.

Work activity		Type of employer						Total	
		University	College	Industry	FFRC	Government	Non-profit organization	N	%
Teaching		10	11	–	–	–	–	21	11
Research		12	–	10	9	10	1	42	21
Res. and teaching		20	15	–	–	–	–	35	18
Res. and dev.		2	–	46	6	12	2	68	34
Engineering		–	–	10	–	2	–	12	6
Consulting		–	–	10	–	–	–	10	5
Nonphysics professional		2	–	3	1	4	–	10	5
Total	N	46	26	79	16	28	3	198	
	%	23	13	40	8	14	2		100%
Extensive use of:	research method	81%	94%	86%	71%	88%	–	157*	
	subject matter	91%	100%	61%	71%	78%	67%	165*	

**Number of respondents to this question.*

Table XI. Median monthly starting salaries paid by U.S. employers to new physics degree recipients, 1990.

Type of employer	Bachelor's degree recipients		Terminal master's degree recipients		Doctorate recipients			
	Percentage accepting positions	Monthly starting salaries	Percentage accepting positions	Monthly starting salaries	Percentage accepting: 'postdocs'	Percentage accepting: potentially perm. pos.	Monthly starting sal. for: 'postdocs'	Monthly starting sal. for: potentially perm. pos.
Secondary school	8%	$2110	8%	$2330	–	–	–	–
College	1	*	6	2280	1%	4%	$2420	$2620
University	4	1750	14	2320	45	7	2310	2670
Industry	45	2350	37	2920	5	13	3330	4020
Gov't. incl. military	38	1940	26	2625	7	5	2830	3550
Fed. Funded Res. Ctr.	2	2580	3	2500	9	2	2500	3820
Other	2	1875	6	*	1	1	2500	*
All employers	100%	$2085	100%	$2760	100%		$2420	$3500

**Insufficient data.*

For purposes of comparison we have added to **Table XI** the starting salaries of physics bachelors. The doctoral physicists are divided into two groups because those who accepted potentially permanent employment are paid significantly higher salaries than the graduates who start out as postdoctoral fellows. Changes from the previous year involve increases of 5% or 6% at all degree levels with the exception of the permanent positions for doctorate recipients where the median did not change. Academic salaries were adjusted for the varying lengths of the school year so that the dollar amounts apply to a month when a teacher is working.

ASTRONOMY

Of the 44 graduate astronomy departments that enrolled the 842 graduate students shown in **Table XII**, twelve of them grant both astronomy and physics degrees. Each year all graduate astronomy students are asked to contribute information to this survey on their educational backgrounds, their levels of graduate study, their areas of concentration and their career plans. **Tables XII** and **XIII** and **Figure IV** represent a statistical summary of those data.

Table XII. Graduate astronomy students* by subfield and years of graduate study, 1989–90.

		Full-time equivalent years of graduate study						Total	
		≤1 yr.	2 yrs.	3 yrs.	4. yrs.	5 yrs.	>6 yrs.	N	%
Distribution of students	N	160	152	160	126	118	126	842	
	%	19	18	19	15	14	15		100%
Astronomy subfields									
Astronomical instruments and techniques		6%	9%	2%	3%	11%	8%	50	6%
Cosmology, extragalactic objects, quasi-stellar objects		25	31	28	28	23	23	219	26
Galactic structure, stellar motions		15	7	8	13	2	9	76	9
Interstellar matter and gaseous nebulae		10	12	12	14	14	18	109	13
Solar system, space astronomy of the solar system		7	6	3	8	10	11	59	7
Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors		11	11	23	16	19	18	135	16
Supernovae, X, γ and cosmic rays, pulsars		5	6	8	7	8	5	59	7
The sun		4	3	2	1	2	–	17	2
Astrophysics		14	12	9	8	6	5	84	10
All other subfields combined		3	3	5	2	5	3	34	4
		100%	100%	100%	100%	100%	100%		

** The percentages shown in this table are based on 607 respondents to the Graduate Student Survey. Astronomy department chairpersons reported a total of 842 graduate students for the survey of Enrollments and Degrees.*

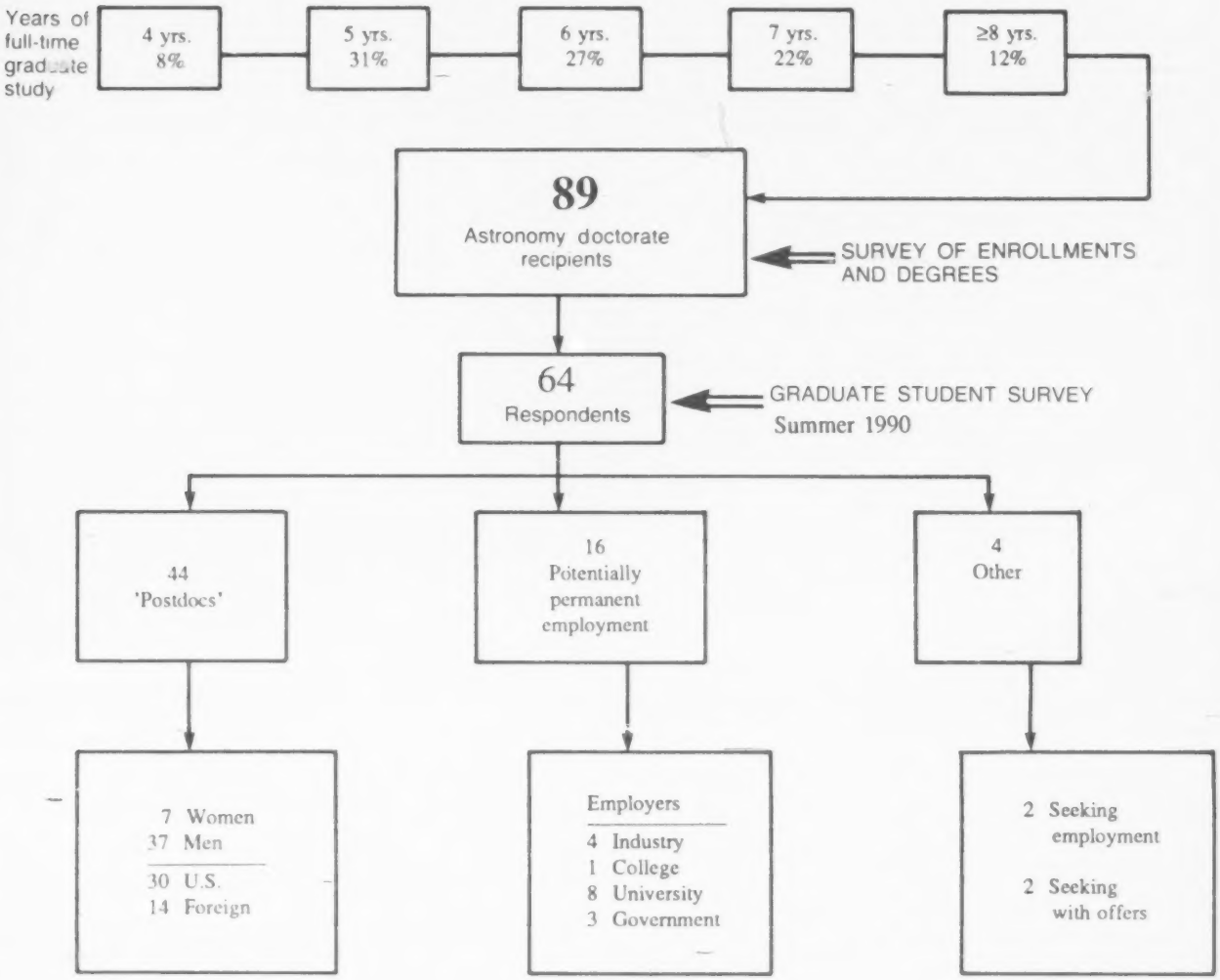
Table XIII. Characteristics of the graduate astronomy student population, 1989–90.

Characteristics		All graduate students	First-year graduate students	Doctorate recipients
	*Total population:	842	186	89
	Number of respondents:	607	110	64
Sex	Female	18%	20%	*19%
	Male	82	80	81
Citizenship*	U.S.	75%	75%	69%
	Foreign	25	25	31
High school physics	Yes	95%	95%	93%
	No	5	5	7
Major of bachelor's degree	Astronomy	36%	38%	38%
	Physics	54	52	52
	Engineering	4	5	5
	Mathematics	2	–	5
	Other	4	5	–
Type of bachelor's institution	PhD-granting	58%	56%	59%
	MS-granting	4	7	6
	BS/BA-granting	13	9	7
	Foreign	25	28	28
Type of graduate institution*	PhD-granting	95%	89%	100%
	MS-granting	5	11	–
	Public	69%	67%	65%
	Private	31	33	35
Source of support	Teaching assistantship	27%	47%	7%
	Research assistantship	50	28	71
	Fellowship	13	12	13
	Family, savings, loan	3	5	5
	Foreign government	1	4	–
	Other	6	4	4
Major subfields	Cosmology	26%	25%	30%
	Interstellar matter	13	10	16
	Solar system	10	7	7
	Stellar atmos. & spectra	16	11	19
	Astrophysics	9	15	3

** These data were reported by astronomy department chairpersons as part of the survey of Enrollments and Degrees.*
Note: Only seventeen students were granted terminal master's degrees in 1989–90, ten of whom responded to this survey.

Although the totals involved are radically different for astronomy and physics students, we adopted a similar format for the two characteristics tables, **XIII** and **I**. The fourth characteristic shows that a majority of the astronomy students chose physics as an undergraduate major. Also, an examination of their choices of undergraduate institutions indicates that astronomers, even more so than physicists, chose PhD-granting universities for their undergraduate education. Similarities among the astronomy and physics students include their high school physics preparation and their distributions between public and private institutions. On the other hand, astronomers have a notably higher representation of women. Regarding their sources of support, we found that teaching assistantships were primarily offered to the first-year students and only a very small fraction of the graduate astronomy students had to resort to loans or personal funds.

Figure IV. Characteristics and post-doctorate status of 1989-90 astronomy graduates.



Additional characteristics of new doctoral astronomers are presented as **Figure IV** which includes data on their post-doctorate employment status. Traditionally a majority of the new astronomers accept postdoctoral fellowships, and for the class of 1990 the median salary is the same as that offered to physicists, namely $2420/month. New astronomers in potentially permanent positions reported salaries whose monthly median was $3000.

This report was prepared with the help of Thomas N. Stovall.